IS BAD CHOLESTEROL A REAL BIOMOLECULE?

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Abstract

The future of science nowadays is to make it accessible to society. The Higher Education students play an important role in this socialization and communication process of knowledge and to this end; they need to know different tools to improve their communication skills. Biochemistry is a subject focused on the study of structure and function of different types of biomolecules. Cholesterol is one of the most popular biomolecule known by most people. In fact, it is closely related to our health status and it is present in our lives. Many people talk about good cholesterol and bad cholesterol, is this correct? With this activity, we expect that our students on Biochemistry subject know how to disclose, in a graphic way and through a simple vocabulary, what they have learnt about this biomolecule. These ideas have to be the most important for people to know about. 32 students have participated in the activity through cooperative work in which they had to record a 2 minutes video explaining the differences between the “two kinds” of cholesterol. They used different ITCs tools chosen by themselves. This activity is part of an interdisciplinary project that proposes the development of a teaching-learning model leading to continuous learning. The students must use the knowledge acquired in other previous subjects of Pharmacy degree like Organic Chemistry. Marks for this activity have scored higher than previous years and some of the projects will be proposed to apply for the scientific dissemination awards for students. Through this activity, the students have been able to adapt their knowledge to a simpler vocabulary suitable for all audiences.

Keywords: biomolecule, video, popular science.

1 INTRODUCTION

According to the World Health Organization (WHO), increased cholesterol is estimated to be responsible for 2.6 million deaths (4.5% of total). Many people talk about good and bad cholesterol. Do they talk about it properly? This is the reason why this activity is focused on cholesterol, one of the most popular biomolecule in our society, because it is closely related to our health status and it is present in our lives. Communication skills in health care professionals are very important. Training programmes in communication skills are unfortunately not present in most of the academic curriculum. The development of generic skills in undergraduate students is considered to be especially important in the process within the European Space of Higher Education, in the area of the health sciences in particular (1). The Higher Education students play an important role in the socialization and communication process of knowledge. Therefore, they need to know different tools to improve these communication skills. In this experience, two subjects have participated: Organic Chemistry during 17-18 course and Biochemistry during 18-19 course. In Organic Chemistry, they study the structure, properties and reactions of organic compounds during their first year of Pharmacy degree. On the other hand, the same students know structure and function of different types of biomolecules in Biochemistry subject during their second year of Pharmacy degree. The students, applying the knowledge acquired from both subjects and through a simple vocabulary, have to explain in a 2 minutes video what they have learnt about this biomolecule. The video has to be focused in the differences between the “two kinds” of cholesterol.

In this project, lecturers of several subjects work together in order to achieve the proposed objectives. There are two main objectives for this type of collaboration: first of all, the students are requested to work on the same concept by applying different points of view across different academic years, thus achieving the interconnection of the information and facilitating the transversality of both the information and the methodologies worked on in the different subjects. Second of all, lectures of different disciplines seek the connection between their subjects, adding to the curriculum with a multidisciplinary component, which makes it possible to give greater importance to each concept and facilitates long-term learning.

From the cognitive point of view, it is very important to equip the student with multidisciplinary skills. This means binding the gap between the theoretical concepts provided in one particular science subject and the practical implementation of this concept to solve a problem presented in another subject with a completely different scientific approach. Another important issue is related with the preparation of the
lecturers. As it has been previously stated, in order to help students learn multidisciplinary skills, teachers have to develop multidisciplinary skills (2).

To this end, we need to establish common areas of coexistence and sharing. Activities such as the one presented here facilitate the creation of these multidisciplinary spaces and provide the right environment to achieve the proposed objectives.

2 METHODOLOGY

Learners of Biochemistry and Organic Chemistry subject collaboratively worked together to prepare the activity. In this experience, 32 students of Pharmacy degree of San Jorge University participated.

2.1 Organic Chemistry activities

In the first year of this Pharmacy degree in Organic Chemistry subject, students learned about structure, properties, and reactions of cholesterol in OC subject. They performed different activities related to this organic molecule:

- First step: Organic Chemistry students had to look for information related to the cholesterol molecule. The information they had to look for was relative to the physical and chemical properties of this molecule with the aim of acquiring basic knowledge of it.

- Second step: Following a bibliographic review, they had to answer a questionnaire about properties of cholesterol:
  1. Chemical structure
     - To draw the chemical structure of Cholesterol.
     - To point out the functional groups
  2. Physical properties
     - To identify the polar and nonpolar areas of the molecule and relate the structure to the solubility of cholesterol in aqueous media and in organic media.
     - What type of intermolecular interactions does cholesterol present?
     - Considering the possible interactions in the molecule, what is the likely physical state to find cholesterol at room temperature?
     - How would you measure its melting temperature point?

- Third step: The students had to deepen in the knowledge of the molecule, paying special attention to the stereochemistry and the organic reactions that cholesterol can produce in the presence of several reagents. The questions of the second part of the project were:
  1. Optical properties
     - Is it a chiral molecule? Do you identify any asymmetric carbon?
  2. Cholesterol reactions. Indicate the by-products of cholesterol in the presence of the following reagents (react only the double bond):
     - Cholesterol + HBr
     - Cholesterol + Cl2 (in CHCl3)
     - Cholesterol + KMnO4 (cold, diluted)

- Fourth step: They had to guess the properties of cholesterol as biomolecule. The idea was to infer the answers from the basic knowledge of the molecule and forecast its behavior. Students could not look for the information of this part of the activity elsewhere. The questions were:
  1. Cholesterol as a biomolecule
     - What group of biomolecules does cholesterol belong to?
     - With respect to cholesterol function.
       - What is the main localization of the cholesterol in the cell?
       - What role does cholesterol play in that structure?
What other biomolecules are derived from cholesterol?

As a future pharmacist, what would I like to know about cholesterol?

2.2 Biochemistry activities:

In biochemistry subject in the second year of the Pharmacy degree the same students must use their knowledge acquired in Organic Chemistry about this biomolecule. Using the previous questionnaire it was checked what the students remembered about physical and chemical properties of cholesterol. The biochemical and biological characteristics of this biomolecule have been explained with a master class. In the final part the students have participated in the activity through cooperative work in which they had to record a 2 minutes video explaining the differences between the “two kinds” of cholesterol. This video will be aimed at all types of audiences. The students could use different Information and Communication Technologies (ITCs) tools chosen by them. Finally, the students complete two questionnaires, one of them about biochemical properties of cholesterol and the other one about the development and usefulness of this activity.

3 RESULTS

The students considered positive the interrelation between two subjects of the degree. The results of questionnaire of two activities have been analysed. For Organic Chemistry, 16 open-ended questions were asked. These questions are related to chemical structure, physicochemical properties, optical properties, reactions of cholesterol and cholesterol as biomolecule. The obtained results show that the weakest part was related to cholesterol as biomolecule. This is because this part will be improved in biochemistry the following year.

In the case of Biochemistry, the final mark of collaborative work of subject was better than previous years. The average score was 8,33. Figure 1 shows video screenshots made by the students.

![Figure 1. Examples of some videos.](image)

Students were presented with five questions about the activity and the results were analysed taking into account the data of likert scale. This scale allocates a quantitative value on a specific question. In this case, the following items were included: strongly disagree, disagree, neither agree nor disagree, agree and strongly agree. The first question (do you think that scientific dissemination among population is important?) yielded positive results because all students (100%) thought that it is important to show science to population. As it can be seen in Figure 2, the second question: “The cholesterol video activity carried out during the project, has been seemed interesting and related to the previous concepts”, 55% of students strongly agree, 35% agree and only 10% neither agree nor disagree. It is important to note, that none of them strongly disagree or disagree.
When students answered the question “The recording of a video seemed an adequate methodology to improve my communication skills”, most of them (45%) strongly agree, 25% agree and 30% neither agree nor disagree. It means, that in general, students think that this activity helps to improve their communication skills (Figure 3).

Another important point that was analysed was the teaching methodologies. In this case, as it is shown in Figure 4, most of students think that new methodologies can improve their learning process. In this sense, 55% of students strongly agree, 35% agree and 10% neither agree nor disagree.
Finally, all students agree that this activity allows them to deepen in the studied topic. The 60% of them strongly agree, 20% agree and 20% answered neither agree nor disagree. This information is shown in Figure 6. The same trend is observed in all of the questions.

Based on the results, we can say that this activity has been well received in general by the students. On the other hand, teachers of these subjects considered the experience very satisfying and productive. They stated that the way of working in a collaborative group is an excellent tool for student's learning and teacher's training.

4 CONCLUSIONS

This activity is a teaching innovation project based on the promotion of integrative learning between the subjects across the Pharmacy degree at San Jorge University. This experience is part of an
interdisciplinary project that proposes the development of a teaching-learning model leading to continuous learning. The students must use the knowledge acquired in other previous subjects of Pharmacy degree like Organic Chemistry. Marks for this activity have scored higher than previous years and some of the projects will be proposed to apply for the scientific dissemination awards for students. After this activity, the students have been able to adapt their knowledge to a simpler vocabulary suitable for all audiences.

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